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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

GRAYBILL, DAVID E

ART UNIT PAPER NUMBER

2827

DATE MAILED: 05/21/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/261,328

Applicant(s)

FERENCE ET AL.

Examiner

David E Graybill

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address. *He*

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 March 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-53, 55, 56 and 58-61 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 10-18 20 25 55 56 58 59 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____

- 4) ☒ Interview Summary (PTO-413) Paper No(s). 16.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____

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Claims 60 and 61 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made without traverse in Paper No. 7.

The amendment to the claims filed 3-11-02 is non-compliant because it fails to conform to the provisions of 37 CFR 1.121(1)(c)(ii):

If a claim is amended by rewriting such claim with the same number, the amendment must be accompanied by another version of the rewritten claim, on one or more pages separate from the amendment, marked up to show all the changes relative to the previous version of that claim.

Specifically, the amendment is not accompanied by another version of rewritten claim 1, marked up to show the addition of the term "C4" to claim 1, line 9, relative to the previous version of claim 1.

Because this is a minor deficiency, and in order to further afford applicant the benefit of compact prosecution, The requirement to comply with the rule within a one month time limit is waived, the amendment is entered, and the claims are examined on the merits.

The amendment filed 3-11-02 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material

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which is not supported by the original disclosure is the claim 1, lines 5, 7, 9, 10 and 12, and the claim 55, lines 5, 7, 9, 10 and 12 limitations "C4."

Applicant is required to cancel the new matter in the reply to this Office Action.

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-6, 10-18, 20, 25, 55, 56, 58 and 59 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention.

The non-described subject matter is the claim 1, lines 5, 7, 9, 10 and 12, and the claim 55, lines 5, 7, 9, 10 and 12 limitations "C4 contacts," and the entire recitation of claims 4, 10-16, 20, 58 and 59.

To further clarify the rejection of claims 4, 10-15, 20 and 59, it is noted that there is no original description of the

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limitation wherein the contacts are aligned by a solder material which is in contact with the contacts when the contacts comprise second contact bumps. Similarly, there is no original description of the limitation wherein the contacts are aligned by a solder material which is in contact with the contacts having the particular dimensions of claims 10-15.

To further clarify the rejection of claim 16, it is noted that there is no original description wherein the contacts are aligned by a solder material which is in contact with the contacts, and the contacts comprise a material having a higher melting point than the first solder bumps.

To further clarify the rejection of claim 58, it is noted that there is no original description wherein the contacts are aligned by a solder material which is in contact with the contacts while all of the plurality of contacts are arranged on the ledge such that a lower surface of the contacts is coplanar with the ledge, and an upper surface of each of the plurality of first solder bumps is essentially aligned with an upper surface of each of the plurality of contacts on a surface of the second substrate opposing the first substrate.

The subject matter of this application admits of illustration by a drawing to facilitate understanding of the invention encompassed by the non-described subject matter of

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claims 1, 4, 10-16, 20, 55, 58 and 59, as set forth in the 35 U.S.C. 112, first paragraph rejection supra. Applicant is required to furnish drawings under 37 CFR 1.81. No new matter may be introduced in the required drawing.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-6, 10-18, 20, 25, 55, 56, 58 and 59 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 1 and 5, it is unclear how the term "C4" further structurally limits the scope of the term "contacts" and the scope of the term "C4 contacts" cannot otherwise be determined.

In claim 58, the limitation, "wherein all of the plurality of contacts are arranged on the ledge such that a lower surface of each of the plurality of contacts is coplanar with the ledge," appears to be incompatible with the claim 55 limitation, "wherein an upper surface of each of the plurality of first solder bumps are essentially aligned with an upper surface of each of the plurality of contacts on a surface of the second substrate opposing the first substrate."

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Claim 58 has not been rejected over the prior art because, in light of the 35 U.S.C. 112 rejections supra, there is a great deal of confusion and uncertainty as to the proper interpretation of the limitations of the claim; hence, it would not be proper to reject claim 58 on the basis of prior art. As stated in *In re Steele*, 305 F.2d 859, 134 USPQ 292 (CCPA 1962), a rejection should not be based on considerable speculation about the meaning of terms employed in a claim or assumptions that must be made as to the scope of the claims. See also MPEP 2173.06.

In the rejections infra, reference labels are generally recited only for the first recitation of identical claim language.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior

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art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 3-6, 18, 20, 25, 55 and 56 are rejected under 35 U.S.C. 102(b) as being anticipated by Nishiguchi (5214308).

At column 3, lines 29-45; and column 4, line 41 to column 6, line 52, Nishiguchi teaches the following:

1. A semiconductor structure for C4 interconnection of semiconductor devices, comprising: a first substrate 3; a second substrate 1 joined to the first substrate; a plurality of C4 contacts [each comprising 5b and "spare solder"] between the first substrate and the second substrate; and a plurality of first solder bumps 2a connected between the first substrate and

the second substrate which substantially align the plurality of C4 contacts, wherein the plurality of first solder bumps are arranged around a periphery of an area containing the plurality of C4 contacts; wherein the plurality of C4 contacts are further aligned between the first and second substrates by a surface tension provided by a solder material 2b which is in contact with each of the plurality of C4 contacts.

3. The semiconductor structure according to 1, wherein at least one of the first substrate and the second substrate is an integrated circuit chip.

4. The semiconductor structure according to 1, wherein the contacts comprise second solder bumps ["spare solder"].

5. The semiconductor structure according to 4, wherein the second solder bumps have a smaller size than the first solder bumps.

6. The semiconductor structure according to 1, wherein the contacts have a smaller size than the first solder bumps.

18. The semiconductor structure according to 1, further comprising: a ledge [narrow flat surface 5a] on at least one of the first substrate and the second substrate, wherein the first solder bumps are arranged in contact with the ledge, such that an upper surface of the contacts and an upper surface of the first solder bumps are co-planar.

20. The semiconductor structure according to 1, wherein the contacts comprise solder.

25. The semiconductor structure according to 1, wherein at least one of the first substrate and the second substrate is an integrated circuit chip, and the contacts are sufficiently small to permit alignment of individual devices on the integrated circuit chips.

55. A semiconductor structure for C4 interconnection of semiconductor devices comprising: a first substrate; a second substrate opposing the first substrate; a plurality of C4 contacts between the first substrate and the second substrate; and a plurality of first solder bumps connected between the first substrate and the second substrate which substantially align the plurality of C4 contacts, wherein the plurality of first solder bumps are free of electrical connection with any of the plurality of C4 contacts, wherein the plurality of C4 contacts are further moved into an aligned position between the first and second substrate by a solder material positioned in tensioned contact with each of the plurality of C4 contacts.

56. The semiconductor structure of 55, wherein the plurality of first solder bumps are arranged around a periphery of an area containing the plurality of contacts.

Claims 10-15 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishiguchi (5214308).

Nishiguchi is applied to the rejection for the same reasons it was applied to claims 1 and 55 supra, and is further applied infra.

Nishiguchi does not appear to explicitly teach the following:

10. The semiconductor structure according to 1, wherein the contacts each have a diameter of less than about 50 μm .

11. The semiconductor structure according to 1, wherein the contacts each have a diameter of about 10 μm .

12. The semiconductor structure according to 1, wherein the contacts each have a diameter of less than about 10 μm .

13. The semiconductor structure according to 1, wherein the contacts have a pitch of less than about 100 μm .

14. The semiconductor structure according to 1, wherein the contacts have a pitch of about 30 μm .

15. The semiconductor structure according to 1, wherein the contacts have a diameter about 20% of the diameter of the first solder bumps.

59. The semiconductor structure of 55, wherein the plurality of contacts comprise a plurality of second solder bumps each having

a volume smaller than a volume of each of the plurality of first solder bumps.

Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

In addition, Nishiguchi teaches the contacts 5b and the solder material 2b having a volume smaller than a volume of each of the plurality of first solder bumps 2a; hence, it would have been obvious to also provide the spare solder second bumps

having a volume smaller than a volume of each of the plurality of first solder bumps in order to maintain a high contact density.

Claims 2 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishiguchi as applied to claims 1, 3-6, 18, 20, 25, 55 and 56, and further in combination with Akamatsu (5611481).

Nishiguchi does not appear to explicitly teach the following:

2. The semiconductor structure according to 1, wherein the contacts have a different composition than the first solder bumps.

16. The semiconductor structure according to 1, wherein the contacts comprise a material having a higher melting point than the first solder bumps.

Nonetheless, at column 3, line 60 to column 4, line 21, Akamatsu teaches a semiconductor structure wherein contacts 2, have a different composition than first solder bumps 3a and comprise a material having a higher melting point than the first solder bumps.

Moreover, it would have been obvious to combine the product of Akamatsu with the product of Nishiguchi because it would provide contacts and first solder bumps.

Claims 1 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Nishiguchi (5214308).

As cited supra, Nishiguchi teaches the following:

1. A semiconductor structure for C4 interconnection of semiconductor devices, comprising: a first substrate 3; a second substrate 1 joined to the first substrate; a plurality of C4 contacts ["electronic circuit of the semiconductor device"] between the first substrate and the second substrate; and a plurality of first solder bumps 2a connected between the first substrate and the second substrate which substantially align the plurality of C4 contacts, wherein the plurality of first solder bumps are arranged around a periphery of an area containing the plurality of C4 contacts; wherein the plurality of C4 contacts are further aligned between the first and second substrates by a surface tension provided by a solder material 2b which is in contact with each of the plurality of C4 contacts.

17. The semiconductor structure according to 1, wherein an upper surface of the contacts and an upper surface of the first solder bumps are co-planar [at the surface of the second substrate].

Applicant's amendment and remarks filed 3-11-02 are addressed in the rejections supra and are further addressed infra.

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Applicant alleges that Nishiguchi does not teach C4 contacts.

This allegation is respectfully traversed because Nishiguchi teaches "A solder joint connecting a substrate and a flip chip, where the surface tension forces of the liquid solder supports the weight of the chip and controls the height (collapse) of the joint," as C4 is defined at page 1135, in Microelectronics Packaging Handbook.

The prior art made of record and not applied to the rejection is considered pertinent to applicant's disclosure. It is cited primarily to show inventions similar to the instant invention.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any telephone inquiry of a general nature or relating to the status (MPEP 203.08) of this application or proceeding should be directed to the group receptionist whose telephone number is 703-308-1782.

Any telephone inquiry concerning this communication or earlier communications from the examiner should be directed to David E. Graybill at (703) 308-2947. Regular office hours: Monday through Friday, 8:30 a.m. to 6:00 p.m.

The fax phone number for group 2800 is 703/305-3431.



David E. Graybill
Primary Examiner
Art Unit 2827

D.G.
19-May-02